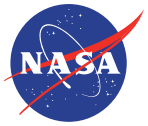

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Integrated Visualization of Multi-sensor Ocean Data Across the Web

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Motivation

Current State of Affairs

Its time in-situ caught up

- In-Situ paired with remote data
  - Provides “ground truth” measurements to support science, satellite mission Cal/Val, and decision support applications
- Accessibility of remote sensing data is incredibly high
  - DAACs have made high quality satellite data readily available
  - Projects like GIBS have made visual aggregation simple
- In-Situ data is on the rise
  - SPURS, OMG, EXPORTS and more are looking to existing national repositories (PO.DAAC) to provide similar exposure

The Complicating Factors

In-Situ data is messy

- Diversity and heterogeneity is inherent
  - Instruments often lack support for self-describing file formats (nc, hdf)
  - Paucity of metadata and/or standards compliant metadata
- Data stewardship is complicated
  - Post-hoc conversion mitigates diversity but places increased cost on DAACs and users
  - The data itself is put at risk as it may be integrated into tools and services at different stages of conversion
- Visualizing the data is complex
  - Large datasets (1,000,000+ data points in a track)
  - Unique patterns and sampling structures

Our Opportunity

Focused integration of diverse platforms

- **Extend** available technologies
  - Address key interoperability and data challenges
  - Focus on marine animal tagging data as a representative use case
  - NCEI .nc templates, ROSETTA, THREDDS, CMC, DMAS, Tagbase
- **Engage** stakeholders throughout the data lifecycle
  - Instrument manufacturers (Wildlife Computers)
  - End-User communities (researchers, application developers)
- **Develop** improved capacity to support field campaign data
  - Integrate new technology components within system workflows
  - Aim to infuse these workflows into DAAC level systems
- **Address** technical barriers to preservation and usability
  - Including eTag datasets
  - Explore efficient data transfer protocols and dynamic subsampling

Project Components

Use Cases

Deciding what our goals are

- Interviewed researchers and scientists specifically working with tagging data
  - PO.DAAC scientists and users
  - AGU 2016, Tuna Conference 2017, IOOS-ATN
  - Collected 34+ detailed use cases and workflow expectations

- Focused on end users (researchers/decision support)
  - Work with data providers to enable these needs
  - Compared existing interaction techniques from other projects

- Highlighted the need for dynamic data synchronization
  - Correlating subset of vertical plot data to horizontal position data
  - Distinguishing relevant large-scale features in remote data

eTag Sensors & Data

Biological “Gliders”

- Horizontally/Vertically resolved physical data
  - Minimally: light level, pressure/Z, temperature
- Diverse sampling rates and coverage
  - Every second or less (< 1 month)
  - Every 30sec - 2min (inter-season/annual)
  - Up to 6 years of operation
  - Easily collect 1 million data points per tag
- Large scale deployment/tagging platforms
  - Generate collections of tracks to study animals en masse

SPOT tag

Implantable Archival Tag

PAT tag on Bluefin Tuna

Rosetta from Unidata

Making data standard again

- Web-based data format transformation service
- Simple interface for converting ASCII to CF compliant netCDF
- Open source
- Uses a THREDDS library to support the Common Data Model
- Extensions for OIIP
  - Pop-up tag datasets
  - Daily summary datasets
  - Bulk transforms
  - Additional netCDF template support

The Data Management and Archival System

Storing data the old fashioned way

- Core of PO.DAACs archive/distribution capability
  - Developed at JPL
- Distributed system architecture based on modular services
  - Data retrieval, storage, access, and formatting
- Extensions for OIIP
  - New data handlers for tag datasets
    - Repackaging (via Rosetta)
  - Additional metadata tracking for new data types
  - Submit to Tagbase ingestion services
  - Expose new data types to external services (OPeNDAP, LAS, etc)

Tagbase

The database tags deserve

- Comprehensive data management solution
  - Support tags from various manufacturers
  - Can handle large dataset collections
  - Based on a unified data relational model that accommodates a suite of formats and metadata
- Provides an integrate set of tools for ingestion and inspection
  - Interact with graphical displays of data
  - Export to dynamically couple to GIS analysis packages
- Extensions for OIIP
  - Porting Tagbase to PostreSQL
  - Integration with DMAS at PO.DAAC

Solr & GeoServer

Reading data over the wire

- Solr provides a thin indexing and query layer
  - Operates on top of an existing storage solution
  - Can be based on files or SQL database
  - Additionally provides some GIS querying

- GeoServer is a full-featured server for geospatial data
  - Integrated data services
  - Open source
  - OGC compliant

- These will comprise the backend of the user facing tool

The Common Mapping Client

Reinventing the wheel so you don't have to

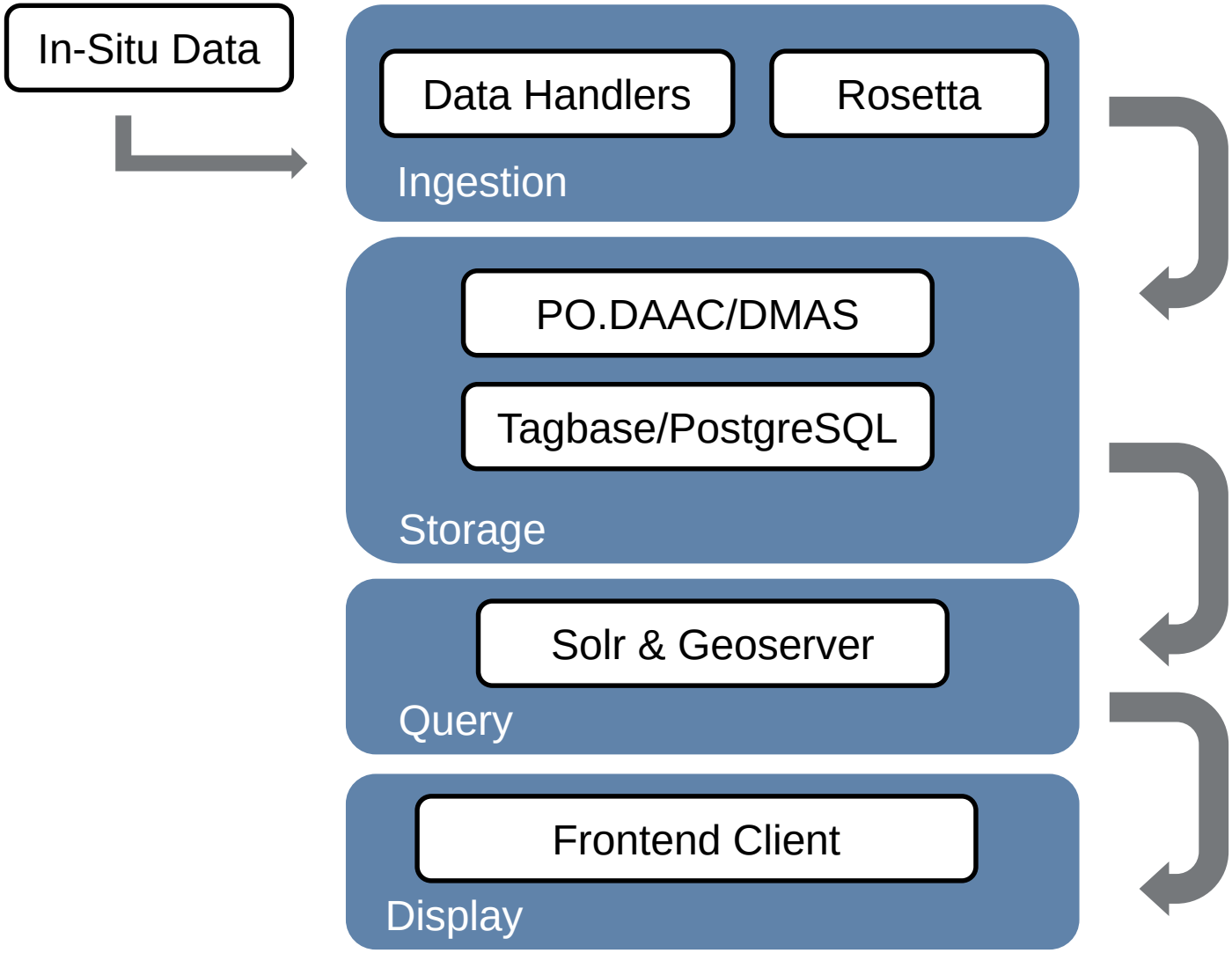
- Web application framework for geospatial visualization
  - Extend basic mapping capabilities to enable more informative interactions
  - Application design focused
  - Open Source*
- Supports diverse user groups and data sources
  - Oceanagraphy, carbon emissions, planetary exploration
- Extensions for OIIP
  - Explore charting support for primary, large scale datasets
  - Provide visualizations for additional data formats

*almost

Less Text, Please

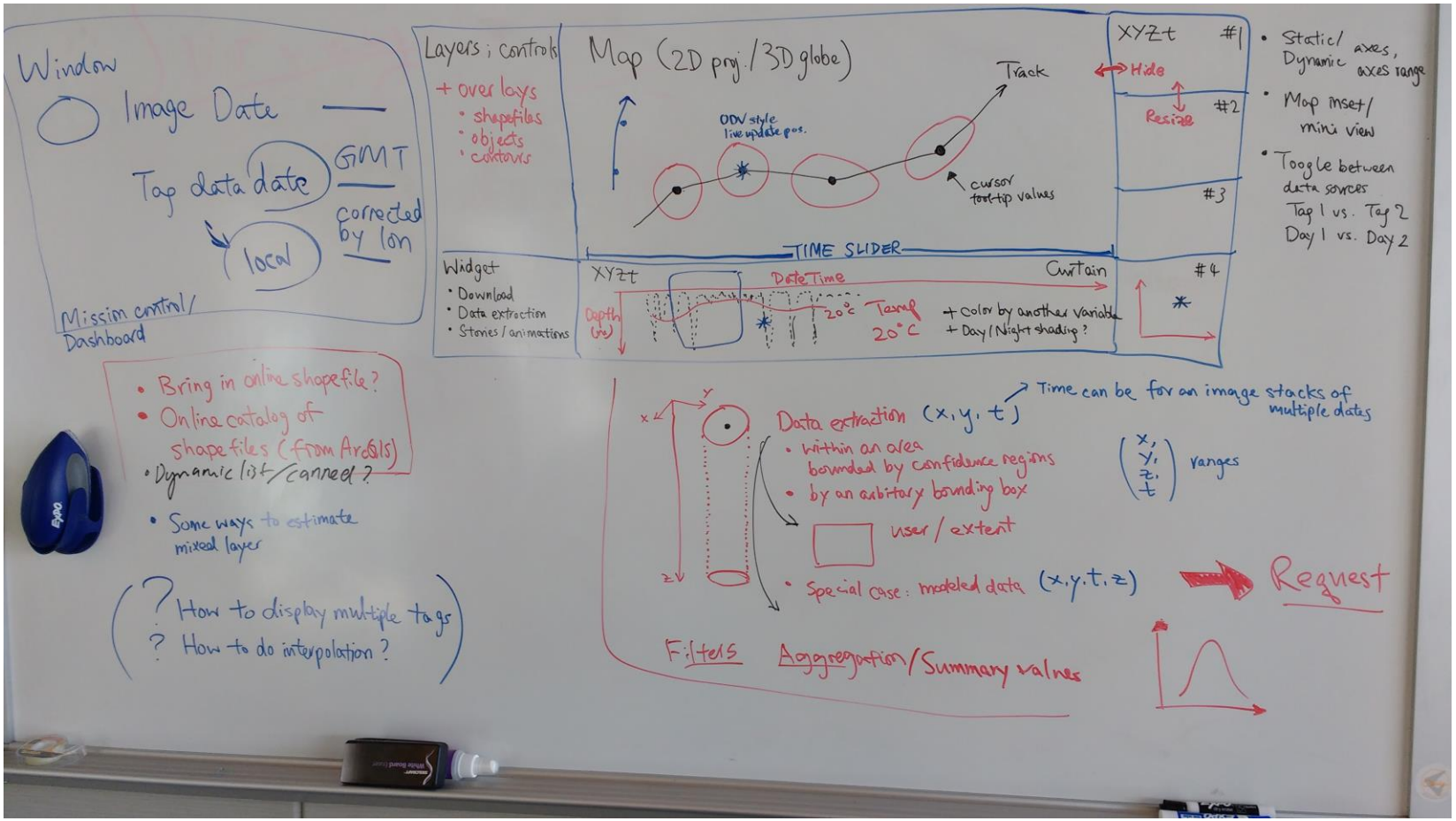
System Architecture

The big picture



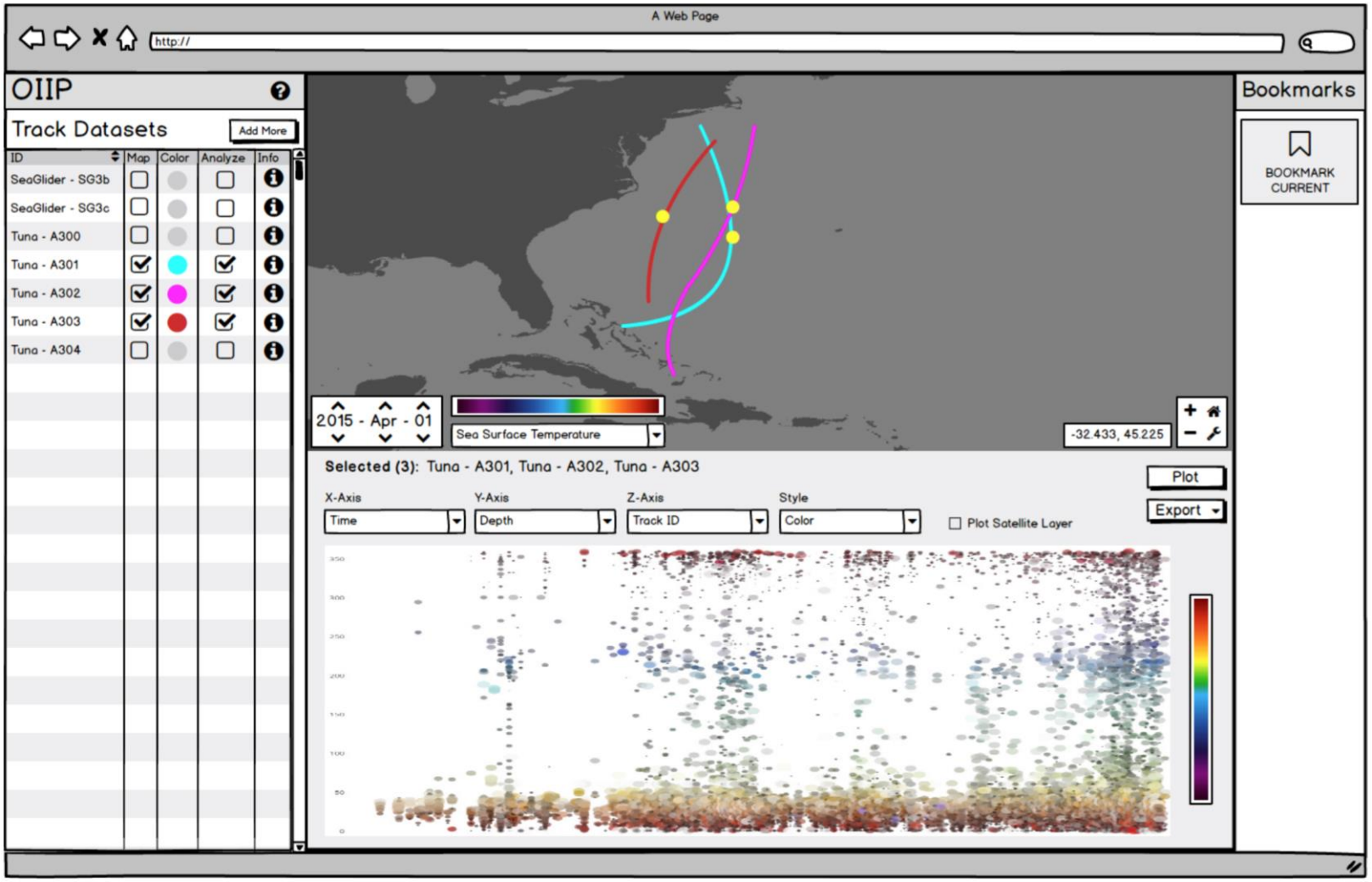
User Interface Design

Where did it start



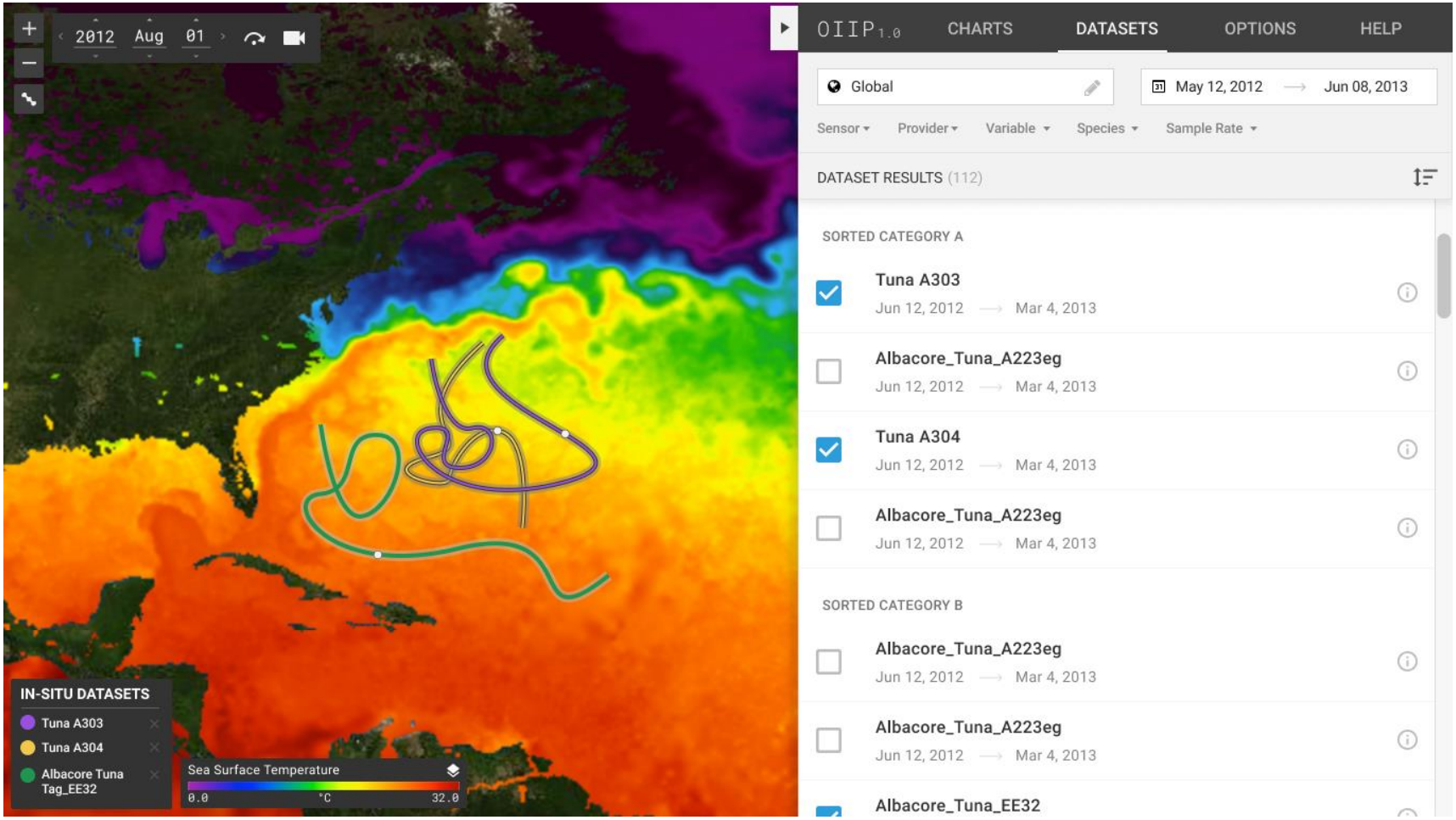
User Interface Design pt. 2

Sketching more ideas



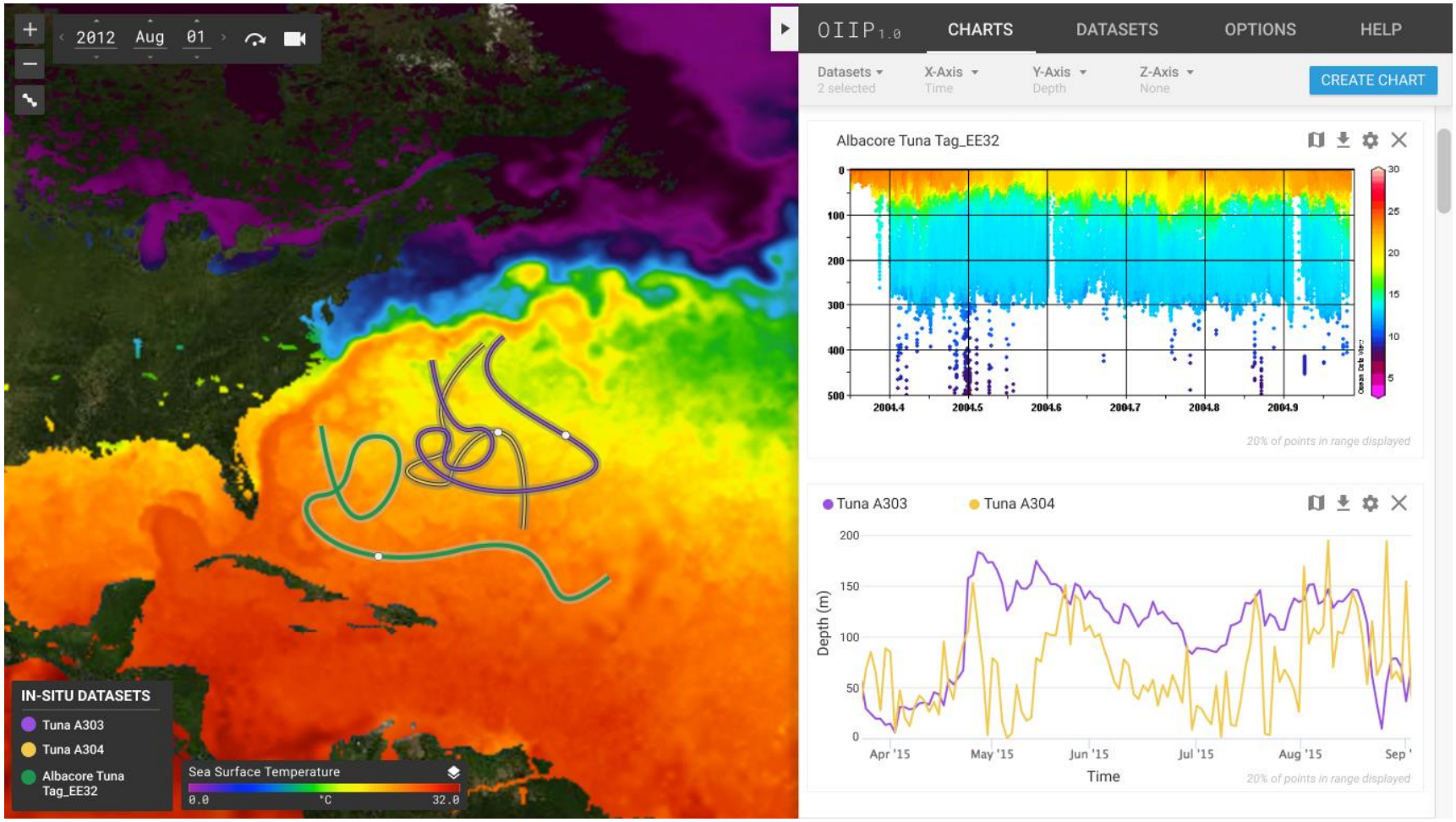
User Interface Design pt. 3

Where we are now



User Interface Design pt. 4

Where we are now cont.



Thank You

https://oiip.jpl.nasa.gov/